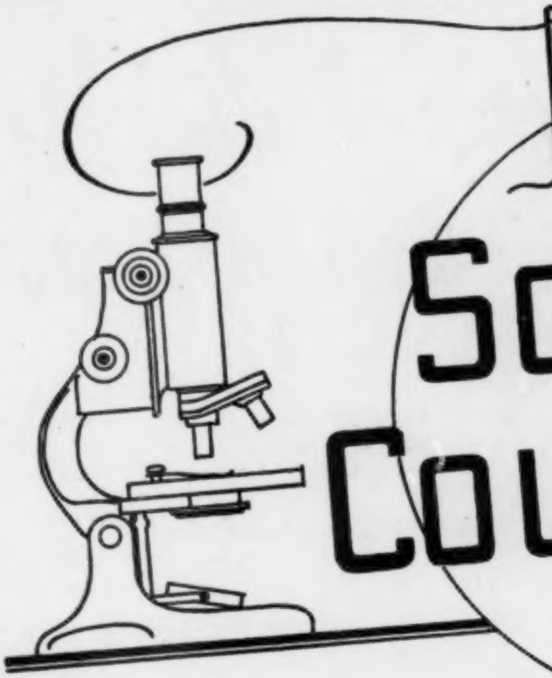

The SCIENCE COUNSELOR

A Quarterly Journal for
Teachers of Science in
the Catholic High Schools

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The Science Counselor

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Volume I. JUNE, 1935 No. 2

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Leaders in Education Say . . .

"I send you my congratulations upon the first number of "The Science Counselor." It is an admirable publication and all its readers will be delighted if all succeeding numbers equal it in excellence.

"I note, in addition to its literary quality and the high quality of its subject matter, the excellent typographical work.

"I wish for the publication the success it rightfully deserves."

MOST REVEREND H. C. BOYLE,
Bishop of Pittsburgh.

"I appreciated very much the opportunity of examining your first issue of "The Science Counselor." This publication will be a source of help to your teachers in keeping abreast with the latest scientific information and modern teaching techniques.

"I should like very much to have the privilege of reading further issues of this most interesting and helpful magazine."

JAMES N. RULE,
Superintendent of Public Instruction,
Commonwealth of Pennsylvania.

With the Editor . . .

THANK YOU

For the many encouraging letters of congratulation and good wishes that have been received since the publication of our first issue, the editorial staff of The Science Counselor is deeply appreciative and grateful. We thank those who not only liked our first number, but who took the trouble to say so. Letters have come from bishops, priests, nuns, state officials of education, university and college presidents, deans, professors, superintendents of schools, high school principals, editors, journalists, public school teachers, science clubs, state teachers colleges, state universities, and the general public. We prize them all.

It is apparent that this journal will fill a need that has long been felt by our teachers. Although the number of subscriptions that we have received is not yet great, twenty-nine states and two foreign countries are already represented on our lists. *Many more persons must subscribe* if this magazine is to become self-supporting. Have *you* sent in one *or more* subscriptions?

OUR ADVERTISERS

Teachers of science can be of assistance to us in a very practical way. Advertising for The Science Counselor is solicited on a business, not a charity basis. To be successful, we must hold our present advertisers and also obtain additional ones. We cannot do so unless the advertisements we carry are productive. Each advertisement is keyed. It must bring returns or it will be discontinued. You will soon be buying books, equipment, supplies, and other materials. Please patronize our advertisers and, in your communications to them, mention The Science Counselor. *This is important.* May we count on your cooperation? Thank you.

SUMMER STUDY

America's great annual summer school trek will soon start. Thousands of our teachers are about to become pupils again. What a fine thing this is for our schools —and for our teachers—especially for our teachers of science.

Every one knows that the most highly educated person, the one with the soundest training, the most comprehensive knowledge, and the highest academic degree, is not always the best teacher. Theoretically, perhaps, he should be; but teaching is an art, and in actual classroom practice he may prove to be only a misfit and a failure. Well-educated incompetents will always clutter the pedagogical field, but they are not a valid argument against better trained teachers. There is much truth in the old saying that it is easier to get a cupful of water from a jar that is full than it is from a jar that has only a cupful in it.

A teacher's educational expenditures cannot exceed his educational receipts. This is self-evident. Every good teacher must know far more than he teaches, and he must strive continually to increase his store of information in any way that he can.

A man's education is not completed when his college course ends. It has only just begun. His formal schooling is only a part, a small part, of the whole and continuing process of education. Granted. The teachers and administrators of all our Catholic secondary schools are beginning to realize, too, that even the academic training must not be permitted to end when the teacher receives his bachelor's degree.

If there were no other good reason for continuing his formal education, the fact that in the educational world the demand is more and more for the highly trained teacher, would force him to continue his schooling. The trend is upward. Already state departments of education and other standardizing agencies are demanding that the teachers in the public high schools shall hold at least a master's degree. Those who teach in the Catholic schools will eventually have to maintain similar high standards. We must prepare for the future.

It is difficult, usually, for a teacher to take a full year or more away from his duties in order to pursue his higher studies without interruption, although without question that is the right thing for him to do. The next best thing is to take summer courses. For a number of reasons these may not be entirely satisfactory, but in the absence of something better, they must serve.

At the end of a year in the classroom, the teacher is tired mentally and physically. He needs a real rest. He hasn't much money. Yet he knows that for his own betterment and for the good of his school, he should continue his collegiate training.

He makes his plans, casually selects his school (often merely because it is close by), and off he goes. If he has not chosen the right school, the summer may not be a profitable one.

Summer students who are as wise as teachers are expected to be, should attend a college or university not because it is handy, but because it is good. Expense must be considered, it is true, but the man who demands excellence of training and not mere academic credits, will realize that things that are really worth while must be paid for. Sacrifice may be necessary, but sacrifice is nothing new to teachers in the Catholic schools. It is unwise to choose a school merely because its tuition rates are low, or because it attracts

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A Medical Expedition to Eskimo Land

• By Charles W. Bauer, M.A. *(Creighton University)*
PROFESSOR OF CHEMISTRY, CREIGHTON UNIVERSITY

Why must Eskimo brides have good teeth? Is it true that almost all Eskimos are susceptible to tuberculosis? Why do Eskimo children never have rickets? How has the theory that eating meat causes high blood pressure been refuted? Do the Alaskan Eskimos live in igloos made of ice? Why are their houses so small?

All these and many other questions are answered in Professor Bauer's story of a land that is too little known.

Get out your map!

One of the greatest difficulties with research work among the Eskimos in Alaska is the getting there. It takes planning, and, as in all countries where much of the traveling is done by water, it takes time.

Not many people realize that Alaska is a land of great distances. The very name Alaska, derived from the Indian word, *Alakshak*, means "the broad country." The word is well chosen, for Alaska occupies an area equal to about one-fifth that of the United States. A mere 60,000 people occupy this vast territory. Of this number 30,000 are Whites, 18,000 are of Indian extraction, and about 12,000 are Eskimos. It was among the Eskimos that we planned to make some interesting medical studies.

We Sail

On June 16, 1934, Dr. Victor E. Levine and I sailed from Seattle on the SS. Aleutian, the flag ship of the Alaska Steamship Company. For six days as we traveled through the inside passage, the "beautiful gateway to the North," we enjoyed a continuous picture of inexpressible beauty: tumbling waterfalls, snow-capped mountains, virgin timberlands, flowers in profusion, and unforgettable sunsets.

Near Cordova in the heart of the copper country of the North we came upon the Columbia Glacier, three hundred and fifty feet high, three and one-half miles wide, and one hundred miles long, the largest glacier in the world that can be approached by boat. We still had perfect daylight when we drew alongside at ten o'clock at night. This was fortunate, for we were able to see this immense field of ice resplendent in all its wonderful coloring. Every color and hue seemed to be there, with delicate blues and greens predominating. It was an indescribably glorious sight, a never-to-be-forgotten one. As we cruised near the glacier we could hear the rumbling noise it makes as it moves forward in its path. When our captain blew sharp blasts on the ship's whistle, the vibrations caused great chunks of ice to break away with a thunderous roar.

At Seward, we entrained for Nenana. This part of our trip took us through Anchorage and the Matanuska coal fields. A stop was made at Curry. On a clear day we saw Mt. McKinley, the tallest mountain on the North American Continent, standing there majestically 20,310 feet above the sea level and 18,000 feet above the plateau on which it rests. The natives call it *Denali*, "the home of the sun," certainly a most appropriate name.

We were interested to learn that the $60,000,000 Alaskan Railroad on which we were traveling brings greater grief than happiness to the Alaskans. Although its passenger and freight rates are excessively high, its competition has caused great numbers of stern wheelers to be abandoned. Hundreds of dog-team freighters have been thrown out of work.

Two Nomite darlings

King Island homes. The walls, roofs and floors of these igloos are made of walrus skins.

At the vilage of Nenana we took a stern wheeler and began our journey down the Tanana, the "river of the mountains," which empties into the mighty Yukon at Tanana. Had we missed this boat, we should have had to wait two weeks for the next one. Scenic Alaska which we had enjoyed so much was rapidly fading into the background. Before us lay our task. We had come to make medical studies of the Eskimos.

The journey down the Tanana was slow. The river is constantly shifting its course, and soundings must be taken at regular intervals. At the stops which were frequent and delayed, we met a number of white people, including several squaw men who were very eager to visit with us. They asked question after question in their keen desire to learn what had been going on in the States. We tried to satisfy that hunger, so well defined by Robert W. Service:

> A hunger not of the belly kind,
> That's banished with bacon and beans,
> But the gnawing hunger of lonely men,
> For home and all that it means.

On June 30, we arrived at Holy Cross. Six hours later we were on our way to Marshall. Holy Cross is one of the finest missions in Alaska, but the children there are largely of Indian extraction, and therefore unsuited for our work. This was our second contact with a Catholic mission. The day before at Nulato, the oldest Catholic mission in Alaska, we had met Father Joseph L. McElmeel, S.J., formerly stationed at Creighton University.

Transportation beyond Marshall is very uncertain. The only scheduled boat trips are those from St. Michael to Marshall about five times each year during the open season. We wanted to go to Akulurak. No one seemed to be sure where this particular settlement is located. In Alaska it is not uncommon to find two towns with exactly the same name, or to come across a single town that has two or more names. Maps proved to be of little assistance. Four different ones showed our village somewhere on the lower Yukon, but no two agreed on the location or even on the spelling of the name.

By a stroke of good luck we met Captain Townsend of the United States Bureau of Fisheries, a man thoroughly familiar with this country. He offered to help. After two days and nights of cruising in and out of the sloughs of the lower Yukon, he brought us to the mouth of the Akulurak River. Here the river had built up a new sand bar, and his boat could take us no farther. It was necessary to hire an Eskimo and his twenty-foot motor-equipped sailboat to complete the last part of our journey.

With the exception of the river banks which are covered with scrub willows, the coast lands in this section of Alaska are hummocky. They are called "tundra" or "nigger heads." During the summer months, despite the fact that frozen earth and solid ice are only a few inches below the surface, a thick growth of lichens and grasses is found. Some of the grasses, particularly the *itat*, are used both for food and in the weaving of baskets. The *siyou* is used to make a medicinal tea, commonly called "tundra tea." Reindeer moss is the most common form of vegetation.

St. Mary's Mission

In this tundra country, near the Bering Sea and on one of the many forks of the south branch of the lower Yukon, is Akulurak. St. Mary's Mission is located there.

Long before our little boat reached the Mission, their Malamute dog team had heralded our approach with a whining and wailing that meant that strangers were coming. The Malamutes cannot bark as our dogs do; they yelp wolf-fashion. Our first glimpse of Akulurak was memorable. There before us were a church, a schoolhouse, dormitories, a work shop, sheds for drying fish, a windmill to generate electricity, and Eskimo chil-

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Preparing a Chemistry Syllabus

● By Sister Mary Margaret, O.S.F., B.S. *(Duquesne University)*
ST. AUGUSTINE HIGH SCHOOL, PITTSBURGH

The Sisters of St. Francis of the Pittsburgh district were dissatisfied with the results of their teaching of chemistry. It was apparent that either their teaching or their testing should be improved.

During the summer vacation the teachers of science were called together so that they might discuss their problems and discover where their chief difficulties lay.

Sister Mary Margaret describes their procedure.

●

As the number of high schools under the supervision of our Community increased, we found it desirable to formulate a chemistry syllabus in order to help coordinate the work in the several schools. A tentative syllabus was prepared, and in September, 1933, each of our chemistry teachers was given an outline which was to guide her in her work.

In practice, this first outline proved to be far too general to be productive of much good. The results of the semester tests were unsatisfactory. These examinations are always prepared at the Motherhouse from material contributed to the supervisor by teachers in all the schools. Not only did a considerable number of students fail to make the required grades, but others—good students, too—developed a dislike for a subject that should be very interesting.

Our teachers realized that practical steps must be taken speedily to solve these problems as well as others which had presented themselves. The need was pressing. It was evident that something was wrong either with our teaching or with our testing. In June, 1934, our science teachers left their classrooms and laboratories with a feeling of dissatisfaction, determined to take some definite measures to discover where our difficulties lay and how they could be remedied.

During the vacation all our science teachers were assembled at the Motherhouse. Through the kindness of the Venerable Mother Superior the entire summer was given to us to discuss our problems, to exchange ideas, and to aid one another by describing the teaching methods and new projects which we had found to be valuable during the course of the year. Better teachers and better teaching would surely result from such a conference.

The teachers were unanimous in agreeing that the first and most necessary work was the preparation of a new syllabus for chemistry, not that the course in every school might be exactly like the course in every other school in all its details, but, rather, that we might all have the same basic plan, an understanding of the topics that should receive the most careful attention, and an agreement as to the rate of progress that might fairly be expected.

At first, we believed that this would be a rather easy task, for the same chemistry textbook was used in all our schools. The actual work, however, proved to be difficult. On many points we could not agree. We learned that individual differences among teachers and students had caused a considerable variation in the emphasis that had been put upon even some very important and fundamental topics. Local conditions, too, had had an effect. Each Sister—as of course she should—held very definite views about each point at issue. There was much discussion, but the work did not progress. Our friendly differences of opinion could not easily be reconciled. Finally, as a compromise, it was agreed that the chemistry outline recommended by the Pennsylvania State Department of Public Instruction should be adopted.

The state syllabus is arranged according to the "unit" plan. In order to follow that plan it would be necessary for us to regroup the material in the textbook we were using to fit the arrangement of the syllabus. We set to work once more. Soon we were in trouble again.

A number of difficulties quickly became apparent, the chief one being that by this new plan, teaching chemistry as well as studying it would be even more difficult than before. The textbook we were using—a good one—could no longer be employed to advantage since the students might find it necessary to turn from a paragraph in the front of the book to another located, perhaps, in the sub-topic of the last chapter. Confusion could not be avoided.

The longer we studied the plan the more unworkable it appeared to be. So many objections were discovered that eventually we abandoned it entirely. We had now been at work for some time, but up to this point the results of our study were entirely negative. Little seemed to have been accomplished.

We continued our deliberations, and as time went on we sought advice and opinions from others interested in this work. Some of the suggestions we received appealed to us. We began to restudy the whole question of high school chemistry. Finally we came to the conclusion that our chief difficulty lay not in our method of testing as some of our teachers maintained, but in our teaching. We began to see that our teachers as a whole were stressing too many points, some of which were not really important. We were trying to cover too broad a field. Some teachers believed that they must teach everything in the textbook. We were not giving enough consideration to emphasis—where it should be used and where it should not be used.

We agreed, finally, that first we would teach, and

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Purchasing Apparatus and Supplies

• By J. O. Bengston
SECRETARY, CHICAGO APPARATUS COMPANY

Every science teacher should know how to purchase laboratory apparatus and supplies to the best advantage. No one should be better able to give advice than a man whose business it is to sell such materials.

Mr. Bengston's article tells the right way of going about this rather unwelcome task.

The purchasing of science laboratory equipment can be a very difficult problem or an extremely easy one depending upon the method of approach. The ideas which we present here may be of service to teachers who are inexperienced in this work.

At the start of our article it will be well, perhaps, to outline briefly and in an elementary way what objectives teachers are trying to reach when they buy science supplies.

The first objective is to secure all the equipment necessary to present properly the particular course in science that is to be offered, regardless of whether it is chemistry, physics, biology, or general science. The second objective is to purchase the very best quality of equipment at a minimum cost. Whether buying for any one or for all the sciences, the situation confronting the purchaser is practically the same.

Very few beginning teachers are sufficiently conversant with the catalogs of the different scientific apparatus houses. Neither are they familiar with the changes in design, specifications, etc., that are occurring constantly. They have but a limited opportunity of knowing why one piece of apparatus, one quality of chemical, or one size of biological specimen is better for their purpose than another seemingly equivalent item. It is hardly to be expected that a science teacher who is fully occupied with classes and with the ordinary problems of teaching should have this knowledge, although, of course, there are exceptions. We know some teachers of science who make as close a study of the catalogs issued by the various laboratory supply houses as do the workers engaged in the scientific apparatus business.

What should those science purchasers, who realize their lack of information, do to make sure they are buying to the best advantage?

The proper approach to buying science equipment is first *to know what you require*. There are several ways of obtaining this knowledge. One good method is to prepare a "Want List" in each subject as the class progresses through its course. On it, shortages of equipment and supplies are noted. At the end of the year's work these lists are combined and placed as an order. A second method is very commonly used but usually it is not as satisfactory as the first method. This is to inventory the laboratory supplies annually.

Knowing what material is on hand, and keeping in mind the yearly requirements, the purchaser can make up his order accordingly. In following this plan, there is always the danger that some important items will be overlooked.

You will notice that we are here considering the accumulation of a yearly or term order, rather than the piece-meal purchasing of items as they are found necessary. Good reasons for such a practice are obvious. A monetary saving is made when equipment is purchased in large lots, both because of the quantity discounts which are allowed by dealers on individual items, and also because of the saving in transportation costs when a bulk shipment is made. Having small lots shipped repeatedly is very expensive.

One difficulty with piece-meal purchasing is that an item is frequently not at hand when it is needed. This results in as poor teaching as does inadequate preparation of any other kind. Pupils and administrators lose confidence in the instructor. Lack of proper materials at the time they are wanted inevitably reminds one of the proverbial plumber story, the workman who always has to go back to his shop for the tools and supplies he should have brought with him.

When a science instructor comes into a school for the first time, he has no previous knowledge of its laboratory facilities and it is, of course, necessary for him to inventory the materials on hand, and to prepare a list of the supplies that will be needed in order to present his course in the way he desires. Later in this article we shall call attention to some time-saving lists that have been compiled by apparatus houses to enable teachers to determine more easily just what they will need to carry out the student experiments and teacher demonstrations that have been planned. It is admitted that any such prepared list does not provide for individual modifications, but the inexperienced teacher is more likely to err by too great a deviation from a course that has been set up by experienced teachers, than he is by adhering too closely to it.

In any well-ordered school, a yearly budget is prepared for the sciences. This budget should provide both for the replacement of supplies and for the addition of new permanent equipment annually. If budgeted properly, by definitely allocating a certain amount to supplies and another amount to permanent equipment, the laboratory in time will become adequately equipped without large expenditures at any one time.

We urge upon the beginning teacher the importance of the proper care of expensive equipment, and the elimination or repair of broken pieces. Our observation has been that administrators will make ample provision of funds for the instructor who keeps his equip-

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How Uncle Sam Protects the Native Denizens of His Great Parks

● By Isabelle F. Story
EDITOR-IN-CHIEF, NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

In the early days, wildlife administration in our national parks was determined largely by the ideas of livestock owners. In recent years, however, equal protection for all has been the aim. Except in extreme and unusual cases, no species is subject to control in order to favor another species.

We are happy to present Miss Story's out-of-the-ordinary account of wildlife protection. It contains information that will make you think.

●

Man has ever been a menace to wildlife. Even to the flora, when he presumes to classify and direct its evolution according to his limited understanding, his rule has been dire misrule, as the now familiar penalties exacted in the increasing consequences of soil erosion abundantly prove. Particularly has the White Race been the offender in this respect. Commenting upon their characteristics, George M. Wright, Chief of the Wildlife Division of the National Park Service, has written "white man's impact upon his environment is tremendous, as compared to that of all other living forms. He is as much like them as cancerous growth is like normal growth and as destructive in effect." Yet, in compensatory antithesis, Mr. Wright also points out that the white man is able to appreciate his effect on his environment and thus become capable of self-imposed restrictions to preserve other species against himself.

America is fortunate in the fact that recent events, economically and in the field of the natural sciences, have awakened the American people to a consciousness of the need for immediate and drastic action, if her still unexampled natural resources are to be saved from neglect and exploitation. Perhaps nowhere has the technique of conservation been developed more intelligently in accord with existing conditions and future needs than in the National Park Service.

Based upon a wildlife survey of the national parks, authorized by that Service, followed by a study of wildlife management—both conducted by the Wildlife Division—a correlated program is being worked out. Many of its features already are in operation. The program closely parallels the research reserves program developed by the Ecological Society of America, and has as its central motif, the treatment of the whole of the park as a primitive area. Except for fish culture, limited trail development, limited insect and fire control practices, the allocations of sites for camps, hotels, and utility groups, and rights of way for roads, our national parks must remain untouched by the despoiling hand of civilization. Such is the policy of the National Park Service.

In the early days, when our national park system numbered only some half dozen areas, wildlife administration was governed largely by the point of view of livestock owners. Predators were anathema. Grazing animals were the major consideration. Yet it should be borne in mind that at this period the buffalo, the elk, and the antelope were so near to extinction that the extermination of such predatory animals as cougars and wolves seemed to justify the means.

Similarly, lack of understanding of the interrelation of wildlife and domestic stock led to much suffering and loss among the former before it was realized that attempts to eradicate rodents and parasitical plants near settlements by the use of poison and the burning of meadows, brought destruction to wildlife.

Conflicts at first arose between man and bird when man applied within the national parks the mosquito elimination processes he had so long employed outside their boundaries. Crude oil meant death to bird and fish, so this, the cheapest and most efficacious mosquito eradicator, had to be eschewed, wherever possible, in the interest of the feathered and finny aborigines of the national parks.

Some classes of birds will not tolerate man's intrusion upon their breeding grounds. Colony nesting and ground nesting species express their resentment by abandoning their eggs and taking flight, sometimes never to return. Wisely the National Park Service therefore now plans the routing of trails or water excursions to give seclusion to these shy parents, and to protect their habitat.

Only in recent years has the principle been laid down of equal protection for all species. Even the rattlesnake is not molested unless found in localities where human beings are concentrated. Thus the National Park Service occupies a unique position. It does not follow the example of individual conservation organizations, existing for the preservation of a special form of life—bird, fish, tree or wildflower. Governmental sponsorship of an area, in the name of the National Park Service, comprehends the conservation of the complete biota. No species is subject to control in order to favor another species, except in extreme and emergency instances. Experience again and again has emphasized the folly of man's interference with nature's balance. Wildlife experts today are arriving, by paths once widely separated, at a point of convergence which confirms the present Federal policy of hands off in the great wildernesses of forest and desert, mountain and woodland lake, which are, and of right ought to be, Nature's inviolate sanctuaries.

On the one side, therefore, there exists today the necessity of giving full protection to the animals. On the other the extension of safety to man. While few

species actually are dangerous to human life, even the rattlesnake being a negligible factor, nevertheless the park denizens in furs and feathers commit acts destructive of property and comfort, while the bear has become a real problem, in his tendency to ape man's most anti-social characteristics. For this, man has only himself to blame. It was he who in the beginning pauperized the bear by insisting upon treating him like a pet, feeding, indulging him, so that today the holdup bear and the rough and disorderly bear are common occurrences. Bears are not innately ferocious, but they cannot be taught manners, and if they usurp the camps and help themselves to other people's food supplies, all that can be done about it is to segregate them in areas remote from the camps.

This is being done, gradually, by moving the feeding platforms, which are the scenes in Yellowstone, Yosemite and Sequoia of the famous bear shows, to more and more remote locations, and gradually cutting down the amount of free lunch until the bears once more are on their own.

Nor is bruin the only species which has made a nuisance of itself, foolishly encouraged by man. The beaver, the porcupine, and the skunk, once timid and wary animals, consort with visitors in many of our national parks to an extent that interferes quite frequently with the comfort of the visitors. To have a porch collapse, for example, because a porcupine has been practicing the art of wood cutting on its legs before your arrival, is an item as awkward as it is unexpected. Once a matronly badger with her two children moved right in to one of the tents and occupied a bed for the night. Beaver show so little consideration for human rights that they have carried out their own ideas of landscaping, regardless of the public utilities thereby put out of commission.

The feeding of game animals in any national park is not in accordance with present park policies. In Yellowstone National Park, in the vicinity of Mammoth, the deer have come to depend mainly upon the local garbage supply for their subsistence. Such a diet is neither normal nor suitable for the deer. Its effect is already beginning to show in their physical appearance and behavior as compared to deer living on the range, remote from civilization. Steps are being taken to put a stop to this practice.

How carefully man should proceed in any interference in nature's exquisitely adjusted balance is mournfully illustrated by the practical extermination of the cougar in Grand Canyon National Park and the Kaibab Plateau. Eloquently has Ben H. Thompson, of the Wildlife Division, summed up this well-meant blunder and its effect:

"Deer and cougar lived together for countless thousands of years before white men came along to protect

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Courtesy Glacier National Park—Photo by Hileman

Lake McDonald, near the western entrance of Glacier National Park, is the largest lake within the park and is considered one of the most beautiful lakes of America.

Should Girls Study Physics?

● By Sister M. Clementine, S.C., M.S. *(University of Notre Dame)*
ST LUKE HIGH SCHOOL, CARNEGIE, PA.

Is a school justified in dropping physics from the schedule when there are no boys in the class? Is the cost of equipping a physics laboratory prohibitive? What can girls learn from the study of physics that will help workers in the home?

Sister Mary Clementine has some interesting ideas on this subject.

●

Should *girls* study physics? Certainly. Those who doubt it have only a meager appreciation of the educational benefits that girls may derive from this science.

The very raising of the question seems to imply that physics is a subject for boys only, and that the proper teacher for it is a man. This view is far too narrow. The profit and pleasure that come from studying the principles of physics and their operation can be enjoyed as much by the mind of woman as by that of man; but since the value of physics for girls has been questioned, it may be worth while to examine briefly some of the advantages that may be gained by those who study this valuable subject.

In the first place, any study that deals with the unvarying laws of nature gives information that will be a valuable addition to our knowledge. Without question it will be of practical benefit. It also affords a special pleasure of its own. No science other than physics puts us so closely in touch every day with Nature. None gives greater benefits to those who are interested in Nature's laws.

Sir Richard Gregory has expressed this idea well: "A direct contact with Nature and inquiring into her laws produce a habit of mind which cannot be acquired in literary fields; and they are associated with a wide outlook on life more than is usually supposed. We can easily justify the claim of science to be an ennobling influence as well as a creator of riches, for science is not to be measured by practical service alone. Though it may contribute to material prosperity, it is an intellectual outlook, a standard of truth, and a gospel of light."

Should the girl student be deprived of this contact?

The virtues of accuracy, persistence, courage, hope and humility that are fostered by the study of the sciences are exemplified in the lives of many eminent physicists. As an instance of courageous hope, one always recalls Faraday's reply to the question regarding the value of a new scientific discovery. As he demonstrated his epoch-making finding of the effect produced when a magnet is thrust within a coil of wire, a woman exclaimed, "But, Professor Faraday, even if the effect you have explained is produced, of what use is it?" His memorable reply, typical of the man of science was: "Madam, will you tell me what is the use of a new-born child?" Faraday's new-born child of science later helped to revolutionize the modern world.

Girls like to understand, and should understand what is going on in the world about them. Every day they read newspaper stories and magazine articles, and they listen to radio talks, many of which are more or less directly concerned with scientific inventions and problems that involve the laws of physics. The high school girl as well as the high school boy comes in daily contact with mechanical devices that involve fundamental physical principles. Why, then, should the girl not have a knowledge of how these appliances operate?

It is not required that she shall be able to construct them. To understand a principle, and actually to make an object embodying the principle, are not identical talents. A boy who knows nothing of the theory of electromagnetic waves, can construct a radio before he ever studies science. On the other hand, many persons enjoy the study of scientific theories and principles, yet are not able to drive a nail or twirl a screw to build a contrivance of even the simplest nature.

A girl can learn and comprehend to her own great satisfaction the physical principles involved in the operation of a telephone. To one who understands its construction, the telephone is never merely a convenience and nothing more. Many of our high school girls, especially in their junior and senior years, operate automobiles. A girl motorist cannot but have a greater interest in a machine whose construction she understands than in one of which she knows nothing. Every girl who drives a car should know at least a little about carburetors, filters, pistons, spark plugs, batteries and the other parts of an automobile. Such knowledge gives her a feeling of greater security. It may be of benefit to her in an emergency. She may avoid humiliating situations. Recently, on her first trip to New York, a high school graduate who was riding in an elevated train innocently inquired what a third rail was. She had to be told how dangerous it is. Had she understood something of electricity she would have been spared considerable embarrassment.

The woman in the home who uses electric irons, percolators, sweepers and other appliances can save many an hour's time and much trouble if in her study of electricity she has learned something of switches and short circuits and resistance. Some housewives who are ignorant of the laws of electricity are extremely frugal of light, and needlessly and unknowingly extravagant in their use of other electrical devices. The study of physics in high school would have taught them how to reduce their electric bills by economizing on the use of electric irons and other labor-saving devices without depriving themselves of the light they need.

For these and other reasons, physics should be made

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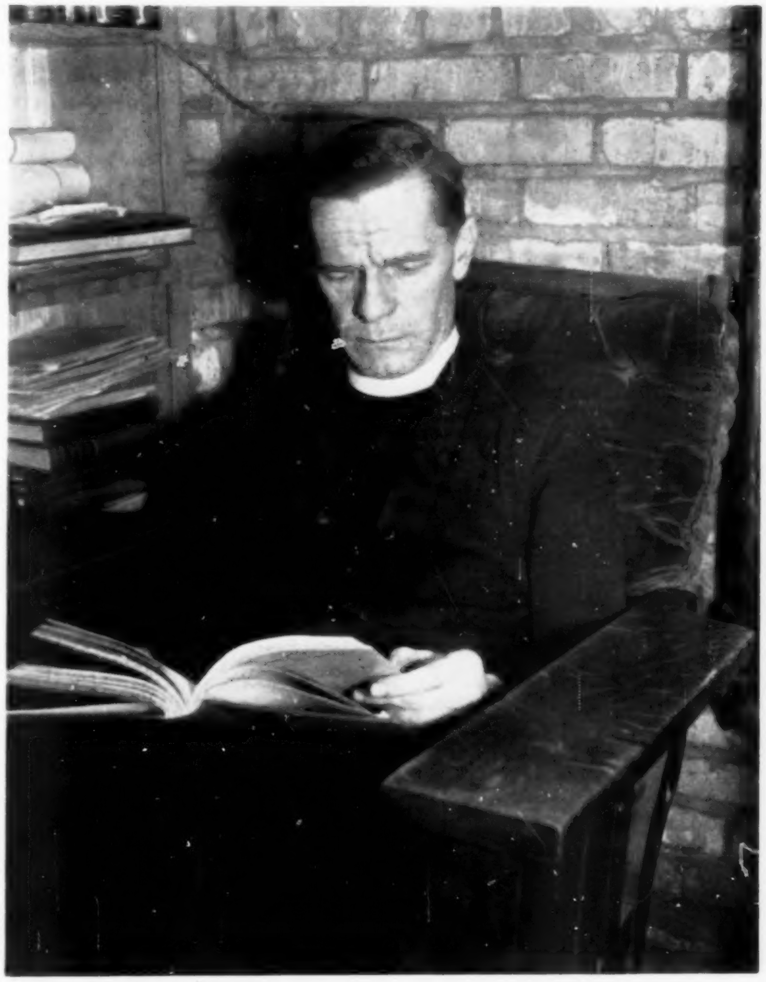
Father Nieuwland and His Work

● **By George F. Hennion, M.S.** *(University of Notre Dame)*
INSTRUCTOR IN CHEMISTRY, UNIVERSITY OF NOTRE DAME

Just a little over fifty-seven years ago, on the fourteenth of February, 1878, to be exact, the tiny village of Hansbeke, Belgium, suddenly became very much alert. In that humble and pious community a birth was (and indeed still is) a notable event, an occasion of general concern and public rejoicing. Very soon the glad news was received by everyone—it was a male child. And so the devout people returned to their labors in the field murmuring a prayer of thanksgiving; and while their hearts were glad their minds did not and could not know that this day a child had been born among them whose name would one day be heard round the world.



REV. JULIUS A. NIEUWLAND, C.S.C., Ph.D., Sc.D.

The recent award of the Nichols medal to Father Nieuwland focussed national attention on this retiring priest-scientist. His achievements in the field of organic chemistry have brought him many other well deserved honors.

The blood of pioneers flowed in the veins of the Nieuwlands; so, though their child was only two years old, they left Hansbeke for distant America, never to return. It was indeed a long and perilous journey in those days, but it was not until they had reached South Bend, Indiana, several months later, that they unpacked their meager possessions to build a new home.

It has been my good fortune on many occasions to have had the pleasure of meeting and talking with people who, as children, knew Father Nieuwland as a young boy. He was always a very active and very studious boy, they say, and in the parochial school which he attended he easily excelled in all his studies. He was never satisfied merely to *know* but wanted always to *understand*. Thus did he early develop the inquisitive mental habits of the scientist.

Having completed his grade-school education he gave heed to the religious zeal which flamed in his heart and enrolled in the seminary of the Congregation of Holy Cross at Notre Dame. Many happy days followed. The scholarly, religious environment and the unbounded opportunities to learn and to serve inspired the young man. In 1899, at the age of twenty-two, he received his A.B. degree from the University of Notre Dame. Then followed a period of several years spent in Washington. D. C., where he pursued philosophical and scientific studies at the Catholic University of America.

He was ordained to the priesthood in 1903 and a year later was awarded his Ph.D. degree by the Catholic University. It is interesting to note that his Doctoral Dissertation was entitled *Some Reactions of Acetylene*. The young priest immediately returned to Notre Dame to join the science faculty of his beloved Alma Mater. Here he has labored most fruitfully ever since.

Father Nieuwland's work during the decade or so after 1904 was concerned primarily with botany. His vigorous mind found much to do. Not only did he immediately undertake a program of botanical research but he also turned his attention to book collecting and to the founding of a journal of natural history. I refer to the *American Midland Naturalist*. Father Nieuwland was not only the founder of this journal

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The Cosmic Ray Mystery

• By Roland Schaffert, Ph.D. *(University of Cincinnati)*
INSTRUCTOR IN PHYSICS, DUQUESNE UNIVERSITY

What are cosmic rays? Where do they come from? What effects do they produce? What is the extent of our present knowledge concerning them? What of the future?

Dr. Schaffert discusses this new branch of physics in a simple, understandable way, giving information that every science teacher will want to have.

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The branch of physics which deals with what are now known as cosmic rays, first made its appearance about 1910. The term "cosmic rays" originated some ten years ago when it was definitely established that these energetic and highly penetrating rays come from regions far beyond the earth's atmosphere. Physicists have sailed around the world, climbed the highest mountains, descended into the deepest mines, and risked their lives in perilous stratosphere ascents in order to study these rays. In spite of the masses of data that have accumulated since their discovery, and the unceasing efforts of investigators, among whom are included such noted men as Millikan, Compton, Kolhörster, and others, many of the aspects of cosmic rays still remain a mystery.

The inquisitive reader may ask: (1) What is the nature of the origin of these rays? (2) What is their place of origin? (3) What is the nature of the cosmic rays? (4) What effects do they produce?

If we could give true answers to all these questions our efforts would be lauded by scientists the world over. The first three of these questions are still being debated. In spite of numerous theories and speculations nothing positive concerning them has as yet been established. We can, however, offer a definite, though not complete answer to the fourth question; but let us start at the beginning.

To begin with, it is pertinent to compare the cosmic rays, at least in effect, with their nearest neighbors, the gamma rays of radioactivity and the X-rays produced by the impinging of cathode rays upon an anticathode. Gamma rays and X-rays are characterized by their high penetrating power and their ability to ionize gases. It it this latter effect which permits a direct measurement of the intensities of these rays. If the gas (or air) surrounding a charged electroscope is ionized, the electroscope begins to discharge; and the greater the ionization, the more rapid is the discharge. If gamma rays or X-rays pass through the gas surrounding the electroscope, the gas becomes ionized. The intensity of the rays is proportional to the degree of ionization, which in turn is proportional to the rate of discharge of the electroscope. This instrument, then, can be used to measure the intensities of these rays.

Up to 1910, no evidence of rays of penetrating power greater than that of the gamma rays of radium had been found. All the rays then known which were capable of penetrating metal walls and of discharging an electroscope, were interpreted in terms of radiations from radioactive substances in the earth's crust, and radioactive emanations getting into the atmosphere. Also, prior to 1910, there was no evidence of penetrating rays entering the earth from outer space.

When, therefore, in 1910, the Swiss physicist Gockel took an electroscope to a height of 4,500 meters in a balloon and found that the rate of discharge was greater than that on the earth's surface, he had really discovered something new. From his results it was concluded that there are "rays at high altitudes coming in from above, originating either in the remoter regions of the atmosphere or else coming in from outer space."[1] Which of these two possibilities was correct was not definitely determined until about 1925.

The accumulated results of the work of Hess, Kolhörster, v. Schweidler, Bowen, Otis, Cameron and Millikan[2] during the period 1910 to 1925 led to the conclusion that these rays come from outer space, or the cosmos, hence the name "cosmic rays."

Penetrating Power

In 1913 and 1914 Kolhörster ascended to a height of 9,000 meters and found the discharge rate of his electroscope to be twelve or thirteen times that at sea level. This meant that the cosmic ray intensity had decreased more than 90% in passing through 9,000 meters of atmosphere. From these results he calculated the absorption coefficient of these rays to be about .55 per meter of water, about ten times as great as the penetrating power of the most penetrating gamma rays (i. e. those emitted from Thorium "C").

Millikan, Otis and Cameron (1922-1925) measured the intensity of cosmic rays under water to a depth of fifteen meters and found them to be at least eighteen times as penetrating as the hardest gamma rays, a penetrating power amply sufficient to get through the atmosphere several times over. Later Millikan and Cameron found rays fifty times more penetrating than the hardest gamma rays. The gamma rays from Thorium "C" are capable of penetrating six inches of lead. This means that the most penetrating cosmic rays yet found are capable of passing through 300 inches, or 25 feet of solid lead. Such powerful rays must necessarily possess enormous energies.

Energies of Cosmic Rays

To measure atomic energies, the physicist has introduced a new energy unit, the "electron-volt." It is de-

termined by the energy imparted to an electron by one electrical volt, and is equivalent to 1.59×10^{-12} ergs.

Since the old absorption formulas do not hold true for cosmic rays, it is not possible to determine the energies of these rays by the use of such formulas. In 1929 Millikan and Anderson, however, designed an instrument for measuring these energies directly. In order to understand the principle of this instrument more clearly, it may be well to discuss briefly some of the secondary effects of cosmic rays. The cosmic rays, themselves, are called primaries. When these rays encounter the nucleus of an atom, positive and negative electrons are emitted, sometimes one at a time, sometimes two; less often, whole showers of positive and negative electrons may be emitted. In addition to the electron showers, in some instances, sprays of large numbers of secondary rays (photons) of the same type as X-rays or gamma rays having relatively low energies, are produced. In these nuclear encounters the cosmic ray imparts its energy to the nucleus. This energy must be accounted for by the kinetic energy given to the positive and negative electrons, if these alone are emitted, and also by the energy imparted to the photons, if any are produced.

The measuring instrument, designed by Millikan, consists of a Wilson cloud chamber placed in a strong magnetic field. Cosmic rays passing through the chamber strike the nuclei of atoms and cause electrons (+ and —) to be emitted. The paths of these electrons can be photographed because of their ionizing effects within the chamber. Due to the influence of the strong magnetic field these paths are curved. Those of greatest energy have the least curvature, while those of relatively small energies have large curvatures. This permits a fairly accurate determination of cosmic ray energies.

Anderson has found cosmic ray energies as high as from six to ten billion electron volts. The most penetrating and most intense constituent of the gamma radiation from Thorium "C" has an energy of 2.62 million electron volts, less than one two-thousandths of the energy of the harder cosmic rays. It is not to be supposed, however, that all cosmic rays possess these high energies. As nearly as can be determined at present, the majority of these rays range in energy value from about 28,000,000 to 10,000,000,000 electron volts.

Mode of Origin

If we are to make any speculations as to the character of the process giving rise to cosmic radiation, we must of necessity presume that such a process is capable of producing energies of at least the same magnitude as those possessed by these highly penetrating rays. Two hypotheses have been suggested: (1) The atom-building and annihilating process, and (2) the presence of a cosmic electric field capable of driving charged particles at enormous speeds. The atom-building process is a special case of mass annihilation, and postulates the building up, somewhere out in space, of higher atomic weight elements out of hydrogen atoms. For instance the building up of a helium atom (atomic wt. 4) from four hydrogen atoms (atomic wt. 1.008) requires the annihilation of a certain amount of mass. If we apply Einstein's equation, $E=MC^2$, for the equivalence of mass and energy, the building up of the remaining elements of the periodic table from hydrogen would involve energies ranging from 28 million to 1,800 million electron volts. This is sufficient to account for the less penetrating components of the cosmic rays. According to this hypothesis it is necessary to postulate the complete annihilation of such atoms as lithium and carbon to account for the harder cosmic rays. This would give energies of seven billion and twelve billion electron volts respectively.

Regarding the second hypothesis Millikan says: "The difficulties with a hypothesis of this latter kind are so great that I have, for the present, discarded it altogether as completely untenable."

Place of Origin

In an attempt to determine the place of origin of cosmic rays scientists have directed their instruments toward the sun, the stars and the planets. They were unable to find differences in the intensities of the rays and concluded that the rays did not come from any of these sources. From measurements on the effect of the earth's magnetic field, it was decided that these rays could not possibly originate in the upper atmosphere.

In 1926 Millikan and Cameron took measurements in South America where they could get entirely out of sight of the Milky Way.

They found no difference in the intensity of the cosmic rays, and concluded that the rays do not come from any of the stars of our galaxy. The conclusion at the present time is that the cosmic rays come from "somewhere" beyond the Milky Way.

The Nature of Cosmic Rays

We now come to our third question: What is the nature of the cosmic rays themselves? Here we have three possibilities: (1) streams of high-speed charged particles; (2) photons of the same nature as gamma rays; (3) a mixture of charged particles and photons.

Three of the foremost American scientists, Dr. R. A. Millikan, Dr. A. H. Compton, and Dr. W. F. G. Swann, working on cosmic rays, have agreed that the third possibility is in accord with experimental findings. They differ, however, as to the percentage of charged particles in this radiation. Dr. Millikan gives the percentage as fifteen or twenty, Dr. Swann would place the percentage at thirty-one, while Dr. Compton reports that all but a fraction of one per cent are charged particles. The answer to this question, as well as to that of questions two and three must await further investigation.

Cosmic Rays and Life

The earth is constantly being bombarded with cosmic rays, and no doubt millions of these rays pass through our bodies during a lifetime. It has been found that such rays as X-rays and gamma rays, in many cases, produce a marked effect upon plant and animal life. Sometimes the effect is constructive, sometimes de-

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Developing an Herbarium

• By Harold W. Werner, M.S. *(University of Florida)*
PROFESSOR OF BOTANY, DUQUESNE UNIVERSITY

Neither lack of time nor lack of money will deter the enthusiastic high school teacher of biology from starting an herbarium for his school. Professor Werner's very practical article describes the several steps to be followed, indicates the difficulties that may be encountered, and shows how an exchange of specimens between schools can be effected.

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Every high school in which biology is taught should have an herbarium. Every high school can have one.

Botany teachers in general recognize the important instructional value of the herbarium as a teaching device, providing as it does throughout the whole year illustrative material for use in connection with the classroom work. Many instructors of high school biology, however, are under the impression that they can afford neither the time nor the money necessary to provide for their department a collection of pressed and mounted plants.

So far as the outlay of money is concerned, the cost can be kept very low; and every enthusiastic teacher who wants to do so can find sufficient time to develop at least a small herbarium. Students may be encouraged to help in the work. Odd hours can be employed to advantage. The time and effort spent will bring in return not only many fine plant specimens, but a vital interest in nature for both teacher and student. Harned, in his *Wildflowers of the Alleghenies*, nicely sums up the value of studying nature by saying, "It provides a physical tonic, a mental stimulant, and a moral antiseptic."

Collecting

The first and most enjoyable work in connection with the building of an herbarium is the collection of suitable specimens. This is best begun in the early spring although, obviously, collections may be started at any time of the year. As the weather becomes warm, both teacher and student will enjoy getting out into the open. If field work is begun early, the progressive changes in the flora of any locality can be noted, and specimens can be gathered in the various stages of their growth. For many species this is very important, since identification is sometimes impossible without an examination of the plant in its different stages of growth.

There are several methods for the handling of plant material in the field. An inexpensive but satisfactory procedure for carrying a small number of specimens on short trips is to use an old magazine of large size. As the specimens are collected they are placed between its pages. A handier method for the transportation of freshly gathered plant material is to put it in a standard collecting can or vasculum. Lining the vasculum with dampened sheets of newspaper keeps the air within it moist and prevents withering. Many collectors prefer to take portable plant presses into the field with them so that they may begin the pressing and drying process as soon as the plant material is gathered. This method yields excellent specimens; but the press is not easy to carry on long hikes, and considerable time is lost opening and restrapping the press for the placing of newly gathered plants.

To a large extent, good judgment and experience must determine the amount and kind of material that should be collected. There are some general suggestions, however, that may be of service to the amateur.

An herbarium should show as many characteristics as possible of each species. All these characteristics must be shown by the specimens which are fixed on sheets of mounting paper measuring about eleven and one-half by sixteen and one-half inches. It may be necessary to obtain specimens of certain plants at several different times to show characteristic stages of growth. Underground portions are often as important as aboveground portions. In some cases the fruit may be more important than the flower. Seeds may be required for a proper identification of a species. Basal leaves, when they differ from the other leaves, must surely be included in the mounted specimens. When the identity of a plant is unknown, it is worth while to collect extra specimens for dissection. If it is planned to build up the herbarium by an exchange of specimens with other collectors, additional material must be gathered for that purpose.

Identification

The determination of the generic and specific names of unknown plants may give considerable trouble to the untrained taxonomist, but help is usually near at hand. Every community has its local botanists, amateur or professional, who have a wealth of information. Botanical societies are always glad to aid those interested in the study of plants. State and federal employees, such as botanists in colleges and agricultural departments, will usually be glad to help with the identification of difficult specimens when their aid is sought. Botanical museums with their herbaria offer valuable assistance.

Before seeking help, however, the collector should attempt to make his own identification by referring to a flora or guide. To determine the anatomical features described in these manuals it is often necessary to use a magnifying lens. Among the better known floras are: Robinson and Fernald—*Gray's New Manual of Botany*, 7ed. (American Book Co.); Britton and Brown—*Illustrated Flora of the Northern United States and Canada*, 3 vols., 2ed. (Charles Scribner's Sons); Small

Collecting

Pressing

Mounting

● LEFT

THE VASCULUM. *Designed for the efficient transportation of plant specimens from field to laboratory.*

● RIGHT

PLANT PRESSES. *In the standard press, pressure is applied by tightening the straps. The improvised press on the left shows how layers of cotton can be used in the drying pile to equalize the pressure.*

● LEFT

FINISHED SPECIMENS. *The center specimen shows the important apical portion of a tall plant. The two end sheets show complete plants.*

—*Manual of the Southeastern Flora*, 3ed. (The Science Press Printing Co., Lancaster, Pa.),

The first two floras mentioned cover largely the northern and eastern quarter of the United States; the third deals only with the southeastern portion of the country. For work on cultivated plants, Bailey's *Standard Cyclopedia of Horticulture*, published by the Macmillan Company, is a necessity.

Besides the more complete floras, there are many smaller works of considerable value. Some are profusely illustrated with colored pictures of plants and, in general, they appeal to the amateur or semi-professional botanist. For the most part these guides cover a restricted area and a limited number of plants. Information concerning this group of publications can best be obtained from librarians and botanists in the collector's community.

Labels bearing the scientific name, place of collection, name of collector, name of person identifying the specimen, and the date of collection should be made out at the time of identification. If the identity of the specimen is not established immediately on returning from the field, a label is prepared, omitting the plant name. These identifying labels are placed between the drying blotters along with the proper specimens.

Pressing and Drying

The pressing and drying of the green plants is a simple operation but it is perhaps the most important step in the preparation of good herbarium specimens. A plant press may be used if one is available. If not, good results are obtained by placing the plant material between pieces of blotting paper, arranging these in small stacks, and covering the stacks with a board which is held down by a rather heavy weight. Two especially important points must not be overlooked. The first is to orient the various plant organs so that the specimen will show its important characteristics; the second is to dry the material rapidly in order to preserve, as far as possible, the natural colors of the fresh material. Both results are easily attained—the first by careful manipulation of the plant during the pressing, and the second by the frequent changing of blotters. As a general rule, specimens should be transferred to dry blotters twice during the first day, and once daily thereafter until the material is dry. When dealing with succulent forms, the bibulous paper must be changed oftener. This renewing of blotters can be done more rapidly and easily if small and delicate plants are placed between sheets of newspaper and kept there during the whole drying process. The necessary pressure for drying the specimens is obtained by tightening the straps on a regular plant press, or by the use of a heavy weight (pail of sand) placed on the board which covers the pile of drying specimens. If regular botanical drying blotters are not available, dry newspapers make a fair substitute.

Mounting

When the plant material is thoroughly dry, it is mounted on botanical specimen sheets. Only one species, though often more than one specimen, is placed on each sheet. The material is best fixed to the sheets by using liquid glue and applying pressure. The specimens should be carefully placed before the glue sets. Portions of the plant which are apt to pull loose are further fastened by the use of adhesive cloth strips or glued strips of heavy paper. The appearance of the mount and its value are determined to a large extent by the care used in collecting and pressing the plant material.

Labeling

The labeling of the specimen sheets, which follows mounting, is a simple process. All that is required is to affix in the lower right hand corner of the specimen sheet a label bearing the information that was assembled at the time of identification. Where serious work is carried on, it is well to keep a special field notebook describing the habitat and other important data concerning each specimen. When this is done, the notebook pages and the specimen sheets should bear corresponding numbers. If desired, this information may be written directly on the specimen sheet, thus eliminating the notebook.

Storing

The species are finally arranged alphabetically in special manila folders called genus covers. All the members of one genus are placed in the same genus cover, and the generic name is printed on the lower right hand corner of the front cover. The folders are then commonly arranged according to the system of Engler and Prantl, which is the system used in most floras.

Specimens should finally be stored in insect-proof cases, although a small herbarium can well be housed in drawers or boxes. The plant material must be kept in the dark to preserve its color. Insect attack is prevented by fumigating the boxes or drawers with carbon tetrachloride from time to time, or better still, by keeping dichloricide crystals in the nearly air-tight specimen case.

Once started, the school herbarium will develop with surprising rapidity. A collector can help himself in many ways by becoming affiliated with his local botanical society. If there is no organized group of this sort in his locality, he may find it to his advantage to organize one.

This journal will be glad to help teachers who become interested in herbaria. A wide variety of specimens for each school is to be desired. Since plants which are very common in one region may be very difficult to obtain in another, exchanges between schools are to be encouraged. In order to help bring about such friendly relations between our schools, THE SCIENCE COUNSELOR, in its December issue and once annually thereafter, will publish a list of Catholic high schools in various parts of the country which have mounted and labeled specimens for exchange. Direct contacts can then be made between the schools.

Those progressive schools that care to participate in an exchange of this nature should so inform the Editor before November 1, 1935.

Science Courses in Catholic Summer Schools in the East

Brief Notes on This Year's Offerings

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During the summer of 1935 most of the outstanding Catholic colleges and universities of the East will conduct standard courses in all their more important departments, including the three major science fields with which we are particularly concerned. The courses offered during the summer session are usually chosen especially to fit the needs of the many teachers who are unable to carry on advanced study during the school year. Some colleges add specialists to their staffs, but in most schools the regular college faculty is used. The courses carry the usual college credit.

Many of our readers are prospective summer students who will want to have information concerning the collegiate courses in science which are to be had either locally or at a distance. To help them, THE SCIENCE COUNSELOR has examined the summer session announcements of a number of Catholic colleges in the East, and presents here a brief account of some of the opportunities, in both the graduate and the undergraduate fields, that are open to the teachers of science in the Catholic secondary schools.

Our list of colleges is necessarily far from complete. Some requests for information remain unanswered. In a few cases the summer program had not been completed early in May when this issue went to press. Every school, however, which supplied the necessary information, is mentioned in this brief survey.

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An educational tour of the Catholic colleges may well begin in New England. Here BOSTON COLLEGE has the field practically to itself. Boston's many places of historical interest and its agreeable climate as well as the pleasant location and excellent equipment of this school make study here attractive. Graduate work is conducted, and research is directed in chemistry and physics. The usual undergraduate courses in these fields are also offered, as well as courses in chemical bibliography and chemical biography. Botany is the only course to be given in the department of biology. A methods course in junior high school science is listed.

In Rhode Island, PROVIDENCE COLLEGE plans to give elementary courses in biology and general physics only.

Studying in a great metropolis has many advantages. In New York City, as is to be expected, are to be found summer science courses in great variety, in both the graduate and undergraduate divisions. Practically any kind of specialized science course that one desires may be had at one or another of New York's great schools.

FORDHAM UNIVERSITY will attract many students by its outstanding courses in a number of the sciences. Valuable graduate courses are here available. Special work and research are offered in botany and zoology, as well as advanced courses in mammalian anatomy, entomology and histology. The chemistry department lists advanced courses in the physical, organic and physiological fields. Many courses in physics are announced. "Methods" courses in biology and chemistry will be given.

MANHATTAN COLLEGE, and ST. JOHN'S UNIVERSITY in Brooklyn also provide courses in the graduate field, as well as the usual undergraduate courses in physics, chemistry, and biology. In the outlying districts several smaller Catholic colleges present elementary science courses.

Up-state in New York, ST. BONAVENTURE COLLEGE will direct a rather extensive group of undergraduate science courses. School hygiene, comparative anatomy, physiology, histology, and nature study are offered by the department of biology, which also lists the usual elementary courses in its field. Inorganic and organic chemistry and qualitative and quantitative analysis are to be taught. The physics department will give courses in optics, and electricity and magnetism in addition to a course in general physics. Valuable methods courses in physics and biology will discuss the problems confronting the high school teacher of these subjects.

CANISIUS COLLEGE is splendidly located in the Buffalo district. Here students will be received for the usual elementary courses in biology, botany, zoology, physics, and chemistry. A course in the chemistry of food and nutrition will be of interest.

Traveling to the south we find that Pennsylvania provides numerous opportunities in science for the summer student. VILLANOVA COLLEGE announces graduate work in atomic physics and physical optics, as well as more elementary courses in general biology, histology, inorganic and organic chemistry and physics. A methods course in secondary school science and a course in educational biology are also to be given.

ST. THOMAS COLLEGE at Scranton in the anthracite region, will limit its summer offerings in the sciences to general biology, inorganic and organic chemistry, qualitative and quantitative analysis and general physics. ST. FRANCIS COLLEGE, beautifully located in the mountains at Loretto, will teach elementary physics, chemistry and biology.

The COLLEGE MISERICORDIA, located at Dallas, restricts its science offerings to general biology and physics. At beautiful SETON HILL COLLEGE in Greensburg, the student may elect courses in phy-

siology, zoology, organic and inorganic chemistry or general physics. Its methods courses in the teaching of physics and chemistry will be helpful. The course in modern physics should interest teachers of physics.

As a great industrial center, Pittsburgh is especially interesting to the student of chemistry. Here DUQUESNE UNIVERSITY provides opportunities for advanced study in physics and chemistry. Spectroscopic analysis, experimental physics, and snythetic organic chemistry are announced. Other advanced courses may be had on request. Courses in elementary electron theory, light, general physics, botany, zoology, general physiology, inorganic and organic chemistry and qualitative and quantitative analysis will be given. The university is featuring three practical courses in the best methods of teaching of physics, chemistry, and biology in the high school. MOUNT MERCY COLLEGE will give courses in general biology and quantitative analysis.

At the great CATHOLIC UNIVERSITY in Washington, D. C., the student may choose from the wide variety and great number of courses in both the graduate and undergraduate fields, that are offered in many departments. In the department of biology, a single course for graduate students only, five courses for undergraduates, and nine courses open to students of both groups, are listed. The chemistry staff presents a course in chemical thermodynamics for graduates only, six undergraduate courses, and four courses of more advanced character. The physics department offers no courses limited to graduate students alone. It does, however, provide the usual undergraduate courses as well as more advanced courses in heat and modern physics. A course in glass blowing should be of practical benefit to workers in physics and chemistry. A course in elementary science for teachers, will discuss the problems of science teaching in the elementary and secondary schools. Interesting courses may be selected from the offerings of the departments of geology and anthropology.

The teachers in the South will be attracted to LOYOLA UNIVERSITY in New Orleans by its well-taught courses in botany, zoology, bacteriology, histology, embryology, and micrology, general and organic chemistry, quantitative analysis and elementary physics.

Far to the north in Cincinnati, the TEACHERS' COLLEGE OF THE ATHENAEUM OF OHIO will offer to its registrants general biology and botany.

XAVIER UNIVERSITY at Cincinnati has on its program interesting courses in general biology, comparative anatomy of the vertebrates, embryology, and comparative physiology. Its offerings in chemistry are limited to organic and general inorganic chemistry. No classes in physics are scheduled. ST. MARY'S OF THE SPRINGS COLLEGE at East Columbus will teach general botany and qualitative analysis.

Many teachers will take advantage of the excellent summer courses offered by the UNIVERSITY OF NOTRE DAME. The highly developed department of biology announces the usual undergraduate courses, together with such courses as personal and community hygiene, elements of immunity, and physical anthropology. Courses in general cytology and the systematic zoology of the invertebrates are listed in the graduate field, as well as research in bacteriology, zoology and botany.

The committee on graduate instruction of the American Council on Education recently approved Notre Dame's department of chemistry as being sufficiently well staffed and well equipped to warrant granting the doctorate in chemistry, a distinction accorded to no other Catholic university. This distinction, and Father Julius A. Nieuwland's fame as a successful research worker will attract students to Notre Dame's chemistry department. As may be expected, unusually fine facilities for research are provided. On the program are advanced courses in organic and physical chemistry, the history of chemistry, and differential calculus as applied to chemistry.

In the physics department graduate work will be offered in physical optics, relativity, radio, mathematical physics, and the mathematical theory of electricity and magnetism.

The UNIVERSITY OF DETROIT announces graduate courses in embryology, heredity and evolution. Research is conducted in biology. The usual undergraduate courses in chemistry are scheduled, with an advanced course in biochemistry. In physics, graduate work may be done in heat, physical optics and special problems.

Beautiful MARYGROVE COLLEGE in Detroit offers biology, entomology, physiology and hygiene, bacteriology, organic and inorganic chemistry, general physics and modern physics.

NAZARETH COLLEGE at Nazareth, Mich., should receive numerous applications for admission to its classes in health education, local flora, general physiology and general biology. The COLLEGE OF ST. BENEDICT at St. Joseph, Minn., offers only biological technique, the anatomy of vascular plants and general inorganic chemistry.

An unusually attractive summer program is presented by MARQUETTE UNIVERSITY'S department of botany. It includes valuable courses that are taught in only a few colleges. Included among them are advanced botany, the identification and classification of trees and shrubs, the identification and classification of seed plants, morphology of the algae, advanced cytology, heredity and evolution, special methods and problems in biological technique, and a seminar in botany.

The chemistry department has arranged an interesting schedule. It includes a course in the methods of teaching chemistry, and advanced work in inorganic preparations, water analysis, iron and steel analysis, advanced organic chemistry, organic technical analysis,

physical, and industrial chemistry, alkaloids, the history of chemistry, selected topics, and a seminar.

The department of physics will give elementary work in general physics only.

Those teachers who find Chicago a convenient city in which to spend the summer vacation are fortunate, for LOYOLA UNIVERSITY and DePAUL UNIVERSITY both provide first-rate instruction in science. Numerous graduate courses are announced. DePaul University lists a special methods course in the teaching of science. Opportunities are provided by the same school for research in chemistry. Courses in physical, and physiological chemistry and organic analysis are scheduled. The physics department is to give advanced courses in heat and in modern physics. The biology department presents genetics and eugenics, bacteriology, angiosperms, micro technique, educational biology, and the anatomy and physiology of the cat. Loyola University will teach general botany, general biology, inorganic and organic chemistry and organic analysis.

ST. LOUIS UNIVERSITY provides a tempting array of courses for those who seek either graduate or undergraduate instruction. The graduate courses will include inorganic chemistry, molecular physics, spectroscopy and advanced physical optics. Research may be undertaken in several fields. A number of courses in the departments of geology, geophysics and astronomy are inviting. Many teachers, however, will be attracted by the excellent courses in human anatomy dissection, bacteriology, immunology, biochemistry, genetics, introduction to paleontology and introduction to animal behavior.

Students at NAZARETH COLLEGE at Louisville, Ky., may elect to study human anatomy, inorganic chemistry, quantitative analysis or general physics.

COLUMBIA COLLEGE at Dubuque, Ia., schedules inorganic chemistry, animal biology, and advanced physics.

Situated at Omaha, the CREIGHTON UNIVERSITY puts its excellent facilities at the disposal of those who are interested in courses in biology, entomology, genetics, general physics, or the usual undergraduate courses in chemistry.

NOTE—While The Science Counselor has taken great care in the compilation of the information here presented, it does not accept responsibility for the accuracy or completeness of its account. Changes in program are often made by colleges, for good reason, after the public announcement of their offerings has been made. Additional classes are often formed when a demand for them is evidenced; other courses may be dropped because of light registration.

Prospective students who are interested in any special course or in any particular school should not depend wholly upon the information contained in this brief account. They should communicate with the school.

Father Nieuwland and His Work

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but he served as its editor for twenty-five years. Aside from his work in chemistry he stands among the preeminent in this country today as a systematic botanist. His herbaria and botanical library are consulted by research botanists the world over.

As time and facilities developed, Father Nieuwland gradually returned to chemistry, a field which today occupies practically his entire time. His work in chemistry has been concerned primarily with the synthesis of new and useful compounds from unsaturated hydrocarbons, especially from acetylene. Dozens of scientific papers have been published from his laboratory dealing with researches in acetylene, olefin and boron chemistry.

Father Nieuwland's best known chemical work is probably that concerned with the catalytic polymerization of acetylene, for this work led to the development of the modern synthetic rubber, "Duprene." His fundamental contribution to this discovery was the development of a catalytic mixture which easily and economically converted acetylene to two important compounds, monovinyl acetylene and divinyl acetylene. This work was discussed before the Organic Chemical Symposium at Rochester, New York, in December of 1925. Representatives of the E. I. duPont de Nemours and Company immediately became interested and arrangements were completed whereby they might add their facilities to the development of these acetylene polymers. After several years of very careful study it was found that hydrogen chloride could be easily reacted with monovinyl acetylene to yield a new compound which was subsequently called "Chloroprene." The latter compound readily polymerizes to "Duprene," a practical and economically feasible synthetic rubber.

Father Nieuwland has received many honors in recognition of his relentless and fruitful scientific researches. He was Secretary of the Organic Division of the American Chemical Society in 1924-5, Chairman of the same in 1925-6, and was elected to membership in the honorary biological society, Phi Sigma, in 1923. He served as Vice President of the Indiana Academy of Science in 1929 and as President of the Academy in 1934. In 1932 Father Nieuwland received the Morehead Medal of the International Acetylene Association. This year the American Institute of the City of New York bestowed upon him the American Institute Medal. Very recently the New York Section of the American Chemical Society awarded him the William H. Nichols medal for 1935.

At the present time the work in organic chemical research in progress at the University of Notre Dame is concerned with three distinct topics: addition reactions of the olefin hydrocarbons, the reactions and properties of the alkyl acetylenes and the chemistry of boron trifluoride and related boron compounds. These three fields are intimately related, for the boron compounds have been found to exhibit marked catalytic properties in both the olefin and acetylene reactions.

A Medical Expedition to Eskimo Land

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dren running wildly back and forth, waving and shouting, "*An umiak! An umiak!*" "A boat is coming!" To them our arival was a real event. Rarely do strange boats sail in those waters, and more rarely still do white men visit there.

When we landed, we were greeted by Father Hubert Post, S.J., and Father Paul Deschout, S.J. Our work kept us at Akulurak for eight days. During this time we were accorded every consideration by the Fathers, by the Sisters who are of the Ursuline Order, and by the boys who ranged from eleven to seventeen years of age. We became very much attached to the children, especially to two of the little boys, Kununak and Chunarhkak. We should like to have found it possible to bring them home with us. The children are, however, very, very happy in the missions which have taken the responsibility of caring for these little folk who have been left homeless by disease and epidemics. As we left Akulurak I realized more keenly than before what a fine work can be carried on by a few godly people.

At the time of our visit Brother Murphy and the older boys were some three hundred miles further up the Yukon gathering their winter's supply of fuel. They gather the wood, build it into rafts, and float it down the river to the Mission. The Eskimos in this vicinity depend upon driftwood which is very scarce. It is this lack of fuel more than anything else that has forced the Eskimos to build their small one-room houses or *igloos*. These are fashioned of driftwood and sod, or of driftwood and walrus skins, and not of ice or snow as many people believe. An igloo that is not more than eight or ten feet square and about five feet high often accommodates as many as ten people. Under such living conditions one cannot expect to find cleanliness. The Eskimos of this part of Alaska are a filthy, unkempt, and unhealthy people.

In striking contrast with the homes of the natives, the buildings of St. Mary's Mission are large, well-built, two-story frame structures. Their foundations are laid on solid ice which is constantly shifting its position. Consequently continual reblocking and repairing are required to prevent the buildings from becoming distorted. The buildings are connected by board walks, for if one walks in the tundra it is necessary to wear shoe pacs since at every few steps one sinks ankle deep in water.

Eskimo Customs

At Akulurak we ate salmon in its most palatable forms. We never knew that fish could be so delicious or so plentiful. By means of two fish wheels the Mission catches its year's supply, 10,000 fish, in three days. Most of these are sun dried.

During the winter months dried fish is the chief food of the Eskimo and of his dog as well. To prepare a fish for the drying rack, the entrails, head, and backbone are removed by a few quick strokes of a sharp knife. In this operation great care is taken not to separate the two sides completely, but to cut within an inch or so of the tail. The fish is then thrown over a pole and hung in the sun to dry. The process requires several weeks, during which time the fish loses about four-fifths of its original weight.

The natives throw the entrails, backbones and heads into a hole in the ground and cover them with weeds and a few shovelfuls of earth. If there is a shortage of food before the next fishing season, they use this decomposed mass not only for their dogs but also for themselves. In fact we saw Eskimos eating this repulsive food when fresh fish were plentiful. When we asked them why they ate it, they smiled and said, "All the same like sauer kraut."

Near Akulurak we found several native cemeteries. In some of these the bodies had been wrapped in reindeer skin and tied to the tops of willow bushes to keep the dogs away from them. In others the corpses had been forced into short wooden boxes which had been set on the surface of the ice. Only in tho mission graveyards did we find the coffins buried.

From Akulurak, we went to Old Hamilton, and from there on to St. Michael, an old deserted town built from timbers brought from Asia. Here, by discovering water hemlock, we disproved the common belief that Alaska has no poisonous plants. We were told that larkspur, lupine, death camas, and monk's hood were also to be found.

On July 24, we arrived in Nome, the metropolis of the Northwest. The town then had a population of 1,310, over half of whom are Eskimos. Here we did the greater part of our research, working with the King Island Eskimos, with those from the Little Diomedes and Cape Prince of Wales, and with the Nomites.

King Island Eskimos

A major objective of our trip was to make a study of the King Island Eskimos; so we were delighted to find them at Nome on their annual three months' shopping trip. We had been told that they were an isolated tribe of veritable giants. We hoped that these reports were true, and that we could learn something specific concerning their foods or inheritance that would account for their unusual size.

They had established their camp about a mile and a half east of the city, and there we found them, the men carving ivory and the squaws sewing and preparing food. One of the most interesting articles of clothing that we saw the women make is the *mukluk*, or Eskimo shoe. The lower part of the *mukluk* is made of walrus skin, which requires hours and hours of chewing to soften and shape it so that it will fit the foot properly. Good teeth are the first requisite of an Eskimo bride.

King Island, which lies in the Bering Sea about forty miles northwest of Nome, is not an island in the ordinary sense of the word, but a great rock over a mile long, three-quarters of a mile wide, and nine hundred feet high. On one of its steep sides is the King Island village. In 1900 this village had a population of 650,

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MORTALITY STATISTICS

	All Causes	Tuberculosis All Forms	Pneumonia All Forms	Influenza	Accidents	Cardiac	Cerebral Hemorrhage	Malig-nancy	Gastro-intestinal	Suicide	Senility	Unknown	All Other Causes
TABLE I.						NUMBER OF DEATHS							
Natives	1216	334	82	365	39	28	2	16	21	4	15	101	209
Eskimos	1128	301	77	353	35	26	1	16	17	4	15	98	185
Half-breeds	88	33	5	12	4	2	1	0	4	0	0	3	24
Whites	265	6	25	24	38	47	12	26	[illegible]	9	7	8	56
				PERCENT OF ALL DEATHS DUE TO INDICATED CAUSES									
Natives	100	27.5	6.7	30.	3.2	2.3	0.16	[illegible]		0.32	1.2	8.3	17.2
Eskimos	100	26.7	6.8	31.3	3.1	2 3	0.09	1.4		0.35	1.3	8.7	16.4
Half-breeds	100	37.5	5.7	13.6	4.5	2.2	1.10	0.0	1.5	0.0	0.0	3 3	27.3
Whites	100	2.3	9.4	9.1	14.3	17.7	4.50	9.8	2.6	3.4	2 6	3.0	21.1
TABLE II.						NUMBER OF DEATHS							
Natives	647	268	41	3	39	23	2	13	20	4	11	76	147
Eskimos	593	239	41	3	35	21	1	13	16	4	11	76	133
Half-breeds	54	29	0	0	4	2	1	0	4	0	0	0	14
Whites	200	2	9	0	35	40	10	24	7	9	5	7	48
				PERCENT OF ALL DEATHS DUE TO INDICATED CAUSES									
Natives	100	41.4	6.3	0.46	6.0	3.6	0.3	2 0	3.0	0.6	1.7	11.7	22.7
Eskimos	100	40.3	6.9	0.50	5.9	3.5	0.16	2.2	2.7	0.6	1.8	12.8	22.4
Half-breeds	100	53.7	0.0	0.0	7.4	3.7	1.5	0.0	7.4	0.0	0.0	0.0	25.9
Whites	100	1.0	4.5	0.0	17.5	20 0	5.0	12.6	3.5	4.5	2.5	3.5	24.0

TABLE I—Actual and relative mortality from important causes among the Eskimos, half-breed Eskimos, and the White population of the Nome and St. Michael precincts of the Second Judicial Division of Alaska during the years 1916-1933.

TABLE II—Actual and relative mortality during the years 1916-1933, omitting 1918 and 1931, epidemic years.

but an epidemic killed 600 of the inhabitants almost over night. No one seems to know just what the nature of the disease was. The 50 who were spared have increased in number until now there are 166 natives on the island. The only white man there is Father Bellarmine Lafortune, S.J., their beloved priest.

The other tribes we found in Nome had come for the same purpose as had the King Islanders, for while the Eskimo uses primitive tools for carving ivory, catching fish, and for hunting many animals, a rifle is always a part of every Eskimo's hunting equipment. He smokes the white man's tobacco, drinks his coffee and tea, eats his sugar and flour, and in the summer time, wears his clothing. However, so far as we were able to observe, he has a violent dislike for the white man's soap. It was conspicuous by its absence.

Late in the summer, after our work had been completed, we left Nome on the "SS. Victoria" which was returning from a special cruise to the ice pack and Siberia. Ours was the last boat to call there before the September fire which destroyed practically the whole city. From Nome we sailed to Dutch Harbor, on by the way of Seal Rocks, Ten Thousand Smokes, Kodiak Island, "Father Hubbard Land," the Columbia Glacier, and down the inside passage to Seattle, arriving there on September 12.

Medical Research

Our medical research took us into many of the more remote parts of Alaska, and gave us an opportunity to study the Eskimo in his own environment. In the main, we confined our studies to children, as we were particularly interested in their health status. Our major studies included:

The taking of about sixty physical measurements of Eskimo children.
Taking samples of blood from these children to be analyzed in our laboratories for inorganic constituents such as iron, calcium, copper, etc.
Testing the Eskimo children's susceptibility to tuberculosis by means of the Mantoux test.
Giving the Schick test for susceptibility to diphtheria.
Giving the Dick test for susceptibility to scarlet fever.
Taking basal metabolisms whenever possible.
Studying the diet of the Eskimo, taking the Eskimo's blood pressure, and gathering mortality statistics.

Dr. Victor E. Levine of the Creighton University School of Medicine, the head of our expedition, deserves great credit for the care and thoroughness with which each test was made. The work was not new to him for he had previously spent many months among the Eskimos of Labrador and Greenland.

We found that 97.3 per cent of the children tested for susceptibility to tuberculosis gave a positive reaction. In many cases these reactions were stronger than those designated by a plus 4. We were told that 50 of the 65 girls in the mission school at Akulurak had had pulmonary hemorrhages at some time during their lives. We saw many children in the last stages of tuberculosis. It was the predominant disease in every village we visited. At present it is the chief cause of Eskimo deaths. Twenty-five of the 26 people buried in the little cemetery at Akulrak had died of it. All were children or young adults.

81.3 per cent of the Eskimo children gave a positive

reaction to the Dick test for susceptibility to scarlet fever. About 80 per cent of them gave positive reactions for susceptibility to diphtheria. If an epidemic of either of these diseases should enter Eskimo land, hundreds of children would die unless they could be immunized.

We found no "pot bellies" among the Eskimos, rickets appearing only among the white children who used neither seal nor cod liver oil.

The King Island Eskimos are taller and huskier than those of the lower Yukon, but they are by no means giants. We found other tribes from farther north just as robust and strong as they. Differences in stature may be due to either of two factors, heredity or diet. A comparison of physical measurements seems to indicate that the Eskimos of the lower Yukon are more of the oriental type. The difference in diet is due to the fact that seal oil is plentiful along the Bering Sea, but it is very scarce on the lower Yukon.

Dr. Levine, who is greatly interested in the food of the natives, made a number of interesting and valuable observations. He was able to refute the theory that the eating of meat causes high blood pressure, by showing that the average Eskimo has a blood pressure of 10 to 20 points below that of the white man, despite the fact that he lives almost wholly on proteins.

Mortality Statistics

An examination of the available death records showed plainly that the Eskimo must keep his blood pure if he would survive. The average spans of life for Whites and Eskimos in the Nome and St. Michael precincts, 1916-1933, were:

White race	53.6	Years
Eskimos	24.7	"
Half-breed Eskimos	9	"
Natives (Eskimos and Half-breed Eskimos)	23.7	"

Almost every child with whom we came in contact had a "head cold." Pneumonia exacts a great toll of lives each year. The influenza epidemics of 1918 and 1931 were so severe that in some cases entire villages were wiped out.

The mortality statistics which we were able to gather, have been combined in Table I. This shows the actual and relative mortality from important causes among the Eskimos, half-breed Eskimos, and the White population of the Nome and St. Michael precincts. In Table II the figures for the epidemic years, 1918 and 1931, were omitted.

Should Girls Study Physics?

Continued from Page Ten

available in our high schools for girls as well as for boys. The practice in some schools of dropping the course when there are no boys in the class is greatly to be deplored. In some girls' high schools, a course in general science is now offered in place of physics. This is unfortunate. General science may be a delightful introduction to the elementary principles of science but it cannot be expected to furnish the mental discipline that is provided by physics. Neither is it acceptable as a unit in satisfaction of the science requirement of the State of other certifying agencies. Physics, on the contrary, is not only approved by these agencies, it is recommended. It should therefore be retained in the course of study even if it is offered only as an elective in the junior, or, preferably, in the senior year.

Some administrators complain that the laboratory equipment is so expensive that they cannot afford to supply it for girls. They point out that but one laboratory science is required for entrance to college, and that their schools are already equipped for chemistry. That may be true. No school, however, should be satisfied with providing mere essentials; and no girl student should be deprived of the opportunity to choose the science which will be most agreeable to her.

The argument that physics is not a definite requirement for college entrance is sometimes used in an attempt to justify the failure to offer this subject. Such thinking indicates a false belief that physics is only for those who are preparing for college, a group that is always in the minority in our high school classes. The direct opposite is true. The girl who goes to college has an opportunity to include physics in her college course, but the one who cannot continue her studies beyond the high school loses her only chance to study the physical laws of nature when physics is not included in the curriculum of the high school which she attends. Brother Felix, F. S. C., says, "Let the student get some inkling of the universe and incidentally let him strengthen his belief in the God who has made all things with number, weight, and measure." That admonition applies to girls as well as to boys.

It is true that expense must be considered. Some of the necessary apparatus is costly, but there is less individual equipment needed for a satisfactory course than is commonly supposed. Much of the apparatus is simple and can be easily procured. Some of it can be made at home. Simple apparatus is quite likely to be the best.

Demonstrations by the teacher, and group experiments by students lessen the amount of equipment required. Experiments dealing with Boyle's law, the Wheatstone bridge, the law of pulleys and many others, are best studied by several students working together. If a small laboratory fee is charged each student, the cost of repairs and occasional new equipment can be met without difficulty.

Some teachers whose schools would find no financial difficulty in equipping a physical laboratory, maintain that physics is too mathematical for girls. Perhaps it is for some girls. But all girls need not be required to study this science, any more than all boys should be compelled to do so. We grant that physics is the most mathematical of the high school sciences, but what consideration shall be given to the girl who really likes mathematics and who plans some day to specialize in that study? In the problems of physics she gets practice in exercising her skill in calculation; the numerous practical applications of the science which she encounters impress upon her the necessity for a knowledge of mathematics.

Most of our teachers are women. Frequently they

are called upon to help out in subjects other than those in which they have specialized. In emergencies they may be required temporarily to conduct classes in physics. The teacher who can do such extra work well is much more valuable than the one who can not. It is true, too, that the knowledge of physics gained in a high school course will be of value to a teacher who later specializes in some other subject.

To review: We should offer to our high school girls a course in physics. We should not be alarmed by the expense involved, for an enthusiastic teacher who knows her business can achieve excellent results at small expense. We should remember that in teaching this subjct we open the minds of our girls to a new view of the world, showing the harmonious working together of all things that God has made, and revealing the marvelous order that is to be found in all Nature, an order that is one of the most decisive arguments that can be deduced from pure reason that there is a Divine Maker of the universe.

How Uncle Sam Protects

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the helpless deer. How much part the cougar played in developing the deer into an animal with its particular type of fleetness, grace, alertness and cunning—the very characteristics which make the deer a deer and not a cow, and hence desirable for recreation and game—we can only conjecture. We do know, however, that in areas where deer have had the predatory menace entirely removed, they have largely lost both the game and the esthetic values . . . When predators are removed, moreover, deer increase like guinea pigs. . . . Large areas of forage have been destroyed in Kaibab National Forest by the oversupply of deer since the cougars were killed off."

Coyotes, like the cougars, have their proper place in the cosmic scheme. This dog-like animal has proved its usefulness as a health officer and game protector. Coyotes remove carrion from watersheds. Because they prey relatively upon more of the weaklings than of the vigorous; upon the diseased, rather than the whole, they assist in building up better breeds and in eliminating disease carriers. The case of the willow grouse is the coyote's best defense. This bird is subject to periodic outbreaks of an endemic disease. Well-meaning sportsmen removed all predatory animals in an attempt to provide more birds for better shooting. Without the carnivores to remove the sick and weakened birds, the disease spread far and wide upon its next recurrence, practically exterminating the willow grouse. It has never recovered its former numbers. Should flesh eaters in habitats of the California quail be removed, it is feared that a similar fate would overtake this valuable game bird. Yet, inasmuch as the coyote, like the ground squirrel and a few other species, thrives on the conditions brought about by civilization, and by his aggressiveness drives out other fauna from their

habitat, it is obvious that in some instances the coyote must be subjected to control.

In Death Valley National Monument house cats are becoming problems. Brought into the area by families who originally occupied Furnace Creek Ranch, the kittens were allowed to live out their normal cycle, nine lives and all. In time they overran the place and began colonizing the nearby mesquite thickets. Here they found a Feline Paradise—water, shelter, abundance of wildlife to prey upon. As a consequence the gambel quail, antelope, ground squirrel, kangaroo rat and pretty little wood rat are today greatly reduced in numbers, while such native carnivores as the desert kit fox have been deprived of food by the depredations of these feral cats. Even the mesquite has been threatened by man's invasion of Death Valley. It has been cut down for firewood and used as browse for burros and mules, until this valuable vegetative cover has been decimated.

Sometimes, however, it is the human species, not the wildlife, who are the victims, as is amusingly instanced by a recent happening in Yellowstone National Park. One morning when the female population at headquarters got up to get breakfast not a coffee pot would perk; no water was to be had. Light, heat and water had been cut off because a family of beaver had been working over time during the night to dam up the Gardiner River in the neighborhood of the power house.

Bears in Yellowstone, Yosemite and Sequoia National Parks, where the daily "bear shows" at feeding time have become world famous, have so gotten out of bounds, with respect to the liberties they take with humans and their property, that Uncle Sam is no longer going to suffer in silence. Bear-proof garbage containers, and more remote location of the bear-feeding platforms are the immediate remedies being applied. Eventually the now pauperized and thoroughly spoiled bruins will be put back in their place; a place they would have been content to keep on occupying, had not man, with his incurable sentimentality, insisted upon treating them like household pets. To present the people to the animals, rather than to present the animals to the visitors as has been so long the custom, will be the future policy of the National Park Service.

Yet never is it forgotten that our national parks belong to the people "for their pleasuring grounds." Potentially their peace and beauty and recreative attributes constitute a refuge without parallel from the confusion and stridency of modern civilization. Man returns from his communion with nature within their fragrant solitudes, restored to sanity of mind and integrity of spirit. Within the areas administered by the National Park Service a truce has been declared between man and beast. The parks are assured of their primeval status. For generations to come they will remain, cherished remnants of our vanished wilderness, unspoiled, unmodified. Here man may renew his reverence for great nature, study the mysterious interrelations existing between plant and animal life, and pay tribute in appreciation and awe to the Great Spirit Who ordained it all.

With the Editor

Continued from Page Three

large numbers of students. Neither size of student body, nor cost of courses, nor beautiful buildings, nor broad acres of campus are criteria of academic excellence.

Knowing the science field in which he desires to work, the prospective student should have little difficulty in ascertaining which are the better schools for his purpose. He should next inquire what instructors are to be in charge of the courses which particularly interest him. A choice of schools should then be easy.

The student should see to it that his instructors will be persons of consequence in their fields, teachers of ability, men or women with whom contact will be inspiring and fruitful. Since education is really self-training under the stimulation, assistance, and guidance of a teacher, the teacher is all important. The careful student will take pains to learn whether the special library and laboratory facilities which are necessary for his work, are available. He will investigate the physical surroundings in which he will be placed, the kind of social life he may expect, the type of acquaintances he may make, and the special opportunities—even if only of rest and recreation—that the location of the school affords.

Science teachers often consider the summer session as a time for doing advanced work in their special fields, work leading perhaps to the doctorate. It may well be just that. No teacher can afford to be indifferent to what is going on in his particular science. Graduate work, under proper guidance, can be fascinating. It is stimulating merely to be where "different" things are being done and new things are being discovered; where the established frontiers of science are being pushed farther on; where the hidden sources of knowledge are being newly tapped by pioneering scientists. The student learns the technique of research; he becomes familiar with its methods and its tools so that later on he can work independently if he cares to do so.

Our Catholic schools need to have on their staffs more teachers highly trained in science. Some of our universities have been justly criticized for their failure to encourage and support an adequate program for scientific research. Until recently they have been concerned with absorptive, not productive, scholarship. There are, however, hopeful signs of an awakening.

For many summer students, "how to teach" science courses will be worth while. The experienced teacher may feel that he knows all about conducting a class in high school chemistry. Possibly he does; but methods courses can always show him something new. They are an incentive to better teaching. They encourage the teacher in service to keep up with the changing fashions in science education. They put him in touch with the latest pedagogical studies in his field and with pertinent articles in the current literature. They may recall to his attention old truths, important truths, that he has long since forgotten.

The teacher of science must not become learned in a single branch only; he must have a well rounded training. For their cultural value, he should select courses which have nothing to do with the subject of his major interest, courses that will bring mental refreshment by giving him new knowledge and new interests, courses that will open wider vistas for thought and achievement. Such study prevents smugness and self-satisfaction. Shelley phrased it well: "The more we study, the more we discover our own ignorance."

The science teacher should study history, economics, languages, literature, philosophy, esthetics. These studies will teach him to appreciate the good things of life, the fine, the beautiful. He will become a man of better understanding, of broader culture, and of more diverse interests.

The teacher who selects his school, his courses, and his instructors wisely, will find that summer study will be a pleasure, not a hardship. He will return to his classroom in the fall refreshed in spirit, keener intellectually, and filled with a new enthusiasm for his work.

He will be less a human vending machine, and more a teacher.

Purchasing Apparatus

Continued from Page Seven

ment in ship-shape order, but they soon become discouraged in attempting to do much for the teacher whose equipment is poorly arranged and carelessly handled.

Assuming that you have either inventoried your laboratories and decided what materials you need, or that you have prepared a list from your accumulation of notes or "want lists," what is the next step?

It should be kept in mind that the catalog prices of any laboratory supply house are subject to fluctuation and cannot be depended upon absolutely. The prices as given in the catalogs indicate the approximate, rather than the exact current price. Since many firms have trained representatives in the field, we endorse heartily the policy pursued by many schools of calling in a salesman of a reputable firm and asking him for the exact prices on the needed materials. The salesman, if he is properly trained, can point out to you some items on your list where a less expensive quality will answer your purpose just as well, or others where an article of improved design can be obtained at the same price. Suggestions from a man who has had years of experience in contacting laboratories may help you to visualize more perfectly what you require to bring your laboratories up to a high standard. The trained salesman is thoroughly conversant with his own catalogs and with those of his competitors. As a consequence he can lighten your work a great deal in this phase of purchasing laboratory equipment.

Some schools make a practice of sending their lists to several houses for quotation. Under the Scientific Apparatus Manufacturers' Code, No. 114, the consumer does not need to protect himself by so doing, for Section 1, Article 2, of Schedule C of this Code provides as follows:

> "The retail prices (of a given firm) to all consumers shall be the same, both on open orders and on competitive bids and shall be the prices established by the individual employer in his current price lists and/or discount sheets. They shall apply alike on all orders for the same quantity of a given item taken at one time and shipped to the same destination. Such prices shall be established independently by each employer. No discounts, other than those established for specified packages and quantities—and filed in member's current price schedule provided for in Paragraph (b)—shall be allowed—"

A purchaser is, therefore, perfectly safe in placing his order with any reputable house with the full assurance that he will receive the best prices. Frequently these prices are below the catalog list.

It is always well to keep in mind the relationship of price to quality. With the tremendous number of items carried in stock by laboratory supply houses, it is obviously impossible for the teacher to check the specifications of the various houses for each item to see which one is superior. He must depend upon the integrity of the firm. A satisfactory method of selecting the house to which you will give your business is to take into consideration the number of years they have been in business, the kind of institutions they cater to, their record, and the manner in which they handle transactions with their customers. If you have not had experience with a particular house, it is easy to inquire of your neighborhood schools what their experience with this firm has been. Too many times schools which have made purchases of science supplies because of a seemingly low price have afterwards regretted the fact that they did not pay a little bit more to secure a great deal more in quality and service.

Occasionally the question arises as to whether it would not be advantageous for a number of schools conducted by the same religious order, or located in the same vicinity, to group their purchases and receive the benefit of lower prices because of the greater amount bought. Some science laboratory supply houses would recommend such a procedure, but in the past where it has been tried—and it has been tried—it has proved to be unsatisfactory for the purchasers. The cost of the redistribution of the materials to the several schools more than offsets the initial cost advantage. This is true not only from a dollar and cents standpoint, but also because the procedure involves an expenditure of time that is unwarranted.

Assuming that the order has been placed with a reputable house, only one other important consideration remains, that is delivery into the hands of the purchaser. Wise and experienced science teachers place their equipment orders early, specifying when the material will be wanted. They are then secure in the knowledge that their supplies will be on hand at the time they are required. Should there be any breakage, an occurrence which is not infrequent in the handling of fragile materials, a report should be made at once to the purveyor of the equipment. Some firms include with their shipment a form on which this report may be made. Others direct that the breakage must be reported to the transportation company and the claim entered against the carrier by the purchaser. Most firms will, on receiving a report of breakage, simply replace the broken articles or make whatever adjustment is necessary without further inconvenience to the school.

A number of supply houses have compiled lists of laboratory equipment covering all the sciences. These indicate the exact materials that are necessary to perform the experiments listed in each of the leading science textbooks. Such lists, properly prepared, are a valuable aid in ordering the supplies and equipment needed for a course. They are sent free of charge on request.

Summarizing: We urge a routine of some nature that will insure that all the material the teacher needs will be placed on the order, and, very important, that the exact sizes and specifications will be given. A catalog number should be shown wherever it is possible.

There should be a definite allocation of funds for science equipment, budgeted according to the requirements—so much for permanent equipment, and so much for usable supplies. When a representative of a reliable firm is in your district, take advantage of his knowledge. He can help you. Place your orders as early as possible, specifying when you want delivery. Deal with one of the reliable laboratory supply houses which have studied school requirements over a period of years and which regularly publish comprehensive catalogs of the materials and equipment they sell.

Preparing a Syllabus

Continued from Page Six

teach well, the necessary fundamentals of the science. Our whole group of teachers would decide what foundational material should be selected for drill. Next we would give particular attention to the topics dealing with the industries of our localities. We would then suggest other material which was desirable but not essential. Beyond that point each Sister would judge for herself what additional topics should be presented to her class. She need not confine herself to material found in the textbook. Furthermore, she was to feel free to omit such topics as she thought undesirable or unnecessary, if our syllabus did not require her to teach them. In preparing the syllabus we would strive for simplicity. We would not include the multiplicity of details that should be provided by the teacher.

When these points had been agreed upon, our teachers set to work with renewed enthusiasm to outline the textbook in accordance with our new plan. The task now became largely a process of elimination. Page after page of the text was reviewed, learning exercises were gone over, and the teachers as a group, keeping in mind the requirements of the state syllabus, selected the topics which should be emphasized, and agreed upon those which should be discussed and those which might possibly be mentioned with profit. Some topics were definitely rejected. The material was then arranged in syllabus form and each of the Sisters was given a copy for her guidance during the present year. The extent of the material to be covered every month was noted.

When at last the syllabus was finished, the Sisters felt that we had accomplished something worth while. We had confidence in the compact, definite and practical outline which we were to follow, for we knew that the syllabus now represented the best thought of all our teachers. The protracted discussions had been valuable for they had brought to our attention many new points in science teaching.

Our outline has been in use during the present school year to the great satisfaction of all our teachers. We Sisters have taught better, for our teaching has been well planned. Our pupils have learned more readily. In our semester tests this year much more satisfactory results were obtained. The students were more keenly interested than before. They seemed to feel that they were accomplishing something. Their awakened interest was reflected in the better grades that they made.

The syllabus is not perfect, of course. It will be revised this summer in the light of the experience that has been gained in its use. It may be elaborated in some respects, but we plan to keep it simple.

After our syllabus had been completed, we decided to provide suitable material for the testing of our teaching. Specimen examinations, each covering two chapters of the textbook, were drawn up for use with the syllabus, each teacher contributing her ideas in the preparation of suitable questions. These general tests

have proved their value. They have saved the individual teacher much time and effort. After each two chapters have been covered, the hectographed tests are ready for use.

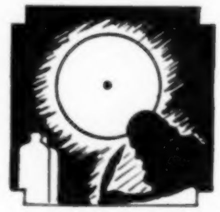
A third problem about which the teachers were deeply concerned was the type of laboratory manual that might best be used with our outline. Many different ones were considered, but none seemed wholly satisfactory. The manual in use in the Pittsburgh public high schools appeared to be suited to our needs, but we found it would be too costly. Finally the Sisters decided to prepare their own work-book.

A great number of experiments, selected from many different sources, were studied. The cost of the chemicals involved and the amount of laboratory equipment required were considered. The most suitable ones were selected and a form of expression decided upon. After each exercise was written, the group of teachers criticized and corrected it. The combined experience of the teachers was invaluable in choosing workable and worth while experiments and in describing them in clear and definite language. Eventually the final selections were decided upon, and the work of mimeographing began.

It required about a week's time to type some one hundred and ten stencils, to mimeograph and sort the sheets and to fasten them together. The cost of the manual was greatly reduced by the use of inexpensive yellow paper.

In actual use this manual has been most useful. It is more satisfactory than any ordinary work-book could be, for it is so well fitted to our course, our pupils, and our laboratory equipment. Our teachers are of the opinion that this manual has had much to do with the improved results obtained in our chemistry courses during the past year.

This summer we plan to make syllabi and manuals for our other science courses.



Fooling the Senses

Hold a finger in a beaker of water at 20° C. Put a finger of the other hand in another beaker of water heated to 30° C. Allow the fingers to remain in the water for a few moments until the temperature of the water becomes less noticeable. Then immediately place both fingers in a third beaker containing water heated to 25° C. What do you observe? Try it again!

Future Numbers
of The Science Counselor

In the forthcoming issues of THE SCIENCE COUNSELOR there will be many interesting articles. We are privileged to announce a few of those which will appear in early numbers.

•

Copernicus
By Dr. James J. Walsh, New York City, author of "The Thirteenth Greatest of Centuries."

•

Turning Science into News
By Dr. Frank Thone of Science Service, Washington, D. C.

•

Carboniferous Flora
By Dr. Adolf C. Noé, Professor of Paleobotany at the University of Chicago.

•

The Flora of Trinidad
By Rev. L. J. Graf, C.S.Sp., St. Mary's College, Port of Spain, Trinidad.

•

Directed Study
By Mary W. Muldoon, Principal, Junior High School, Waverly, N. Y.

•

How Earthquakes Are Recorded
By Rev. J. Joseph Lynch, S.J., Head, Department of Physics, Fordham University.

•

Teaching Biology to the Blind
By Dr. Robert T. Hance, head of the Department of Zoology, University of Pittsburgh.

•

Science in the Vegetable Garden
By Dr. George J. Raleigh of the Department of Botany, Cornell University.

•

Modern Aspects of Chemical Warfare
By Gerald McDonald, Professor of Physics, St. John's University, Brooklyn.

•

X-Rays and Their Application
By Dr. J. S. Broderick of Antioch College, Yellow Springs, Ohio.

•

Chlorophyll
By Rt. Rev. George Barry O'Toole, head of the Department of Philosophy, Duquesne University.

The Cosmic Ray Mystery

Continued from Page Thirteen

structive. Scientists have suggested that cosmic rays may also affect the life and growth of plants and animals. However, experiments on mice, placed in a silver mine near Oslo, where no cosmic rays could reach them, showed that no noticeable effects were produced.

Experimental data on this phase of cosmic rays are very meagre. We must await further investigations before any definite conclusion can be established.

Summary

The known facts concerning cosmic rays may be summarized in the following statements:

(1) They come from regions beyond the Milky Way.

(2) The only tenable hypothesis presented thus far, as to the manner in which they are produced is that of the "annihilation of matter."

(3) They have penetrating powers ranging from about three feet to twenty-five feet of lead.

(4) They have energies ranging from about twenty-eight million to ten billion electron volts.

(5) They are capable of disrupting atomic nuclei in such a manner as to eject positive and negative electrons and protons.

(6) They are responsible for a large part of the ionization of the atmosphere.

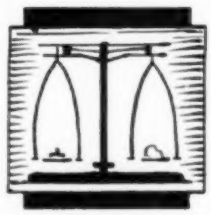
(7) At the present time these rays appear to be a mixture of photons and high speed charged particles.

(8) As yet scientists have not observed any positive effects upon life due to cosmic rays.

This is the present state of affairs in regard to the cosmic ray mystery. What strange facts future investigators may reveal, we can only conjecture.

Reference

1, 2, 3 Millikan; *Electrons* (+ and —), pp. 304, 313, (1935).



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